On-farm Validation of Cultural Practice Adjustments to Improve White Mold Management in Dry Bean Irrigation Systems

H. F. Schwartz* and M. A. Brick

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M. S. McMillan, K. Otto, and J. B. Ogg - Colorado State University

ABSTRACT:
This project (2010 was the 2nd year request) investigated the roles of cultural practices and timely application of a fungicide in reducing damage from *Sclerotinia sclerotiorum* to *Phaseolus vulgaris* cultivars with varying degrees of resistance (plant architecture – disease avoidance, interspecific resistance) when grown under different irrigation systems. These objectives support the Sclerotinia Initiative (SI) area of Pathogen Epidemiology & Disease Management (including crop production practices and chemical control); and are relevant to PM 4.0.7 of the Strategic Plan for the Sclerotinia Research Initiative.

This project conducted a replicated field trial in white mold-infested grower fields to investigate the role and value of cultural practice modification within an Integrated Pest Management context that compares the effects of added fertilizer and/or fungicide when promising varieties are grown under varying irrigation systems on grower fields. During 2009-10, we encountered low white mold pressure in fields with a history of the disease apparently due to delayed plantings (early-spring rains both years) which delayed flowering until late July when weather conditions were warm and dry. Yields of the 4 entries averaged 1135 lb/acre (1281 seed/lb) at the research station and 2966 lb/acre (1204 seed/lb) at the better commercial field in the absence of white mold and with moderate bacterial disease at the commercial field in 2010; similar to results obtained in 2009. When combined over locations, yield ($P < 0.05$) and seed size ($P < 0.05$) differences between entries were significant. Plant canopy monitoring during late vegetative to seed fill periods of crop growth showed that average daily relative humidity was higher in a prostrate variety (Montrose) than an upright type (Stampede); and canopy temperature showed the reverse trend. Field data during the proposed 2011 study will include microclimatic monitoring, soil fertility, plant stand, disease intensity, yield, seed size, and economic impacts. Results will be shared with colleagues and growers via progress reports, refereed publications, extension releases, web sites, and meetings. Agronomic and chemical (fertilizer, fungicide) implications from this IPM approach will be applicable to other host cropping systems affected by foliar phases of white mold.

CONTACT Information: Dr. Howard F. Schwartz, Colorado State University, C205 Plant Science Bldg.–BSPM, Fort Collins, CO 80523-1177; 970-491-6987; Howard.Schwartz@ColoState.edu

GOAL and OBJECTIVES:

The goal is to define production and IPM systems that will minimize losses from white mold, while maximizing production and economic returns to growers. Results can be applied to other crop – white mold systems.

Objectives are to: investigate the roles of cultural practices (fertilizer rate, promising varieties), and timely application of a fungicide in reducing damage from *Sclerotinia sclerotiorum* to *Phaseolus vulgaris* cultivars with varying degrees of resistance (plant architecture – disease avoidance, interspecific resistance) when grown under different irrigation systems on an experiment station and in grower fields.

MATERIALS AND METHODS:

Fungicide treated seed (standard commercial treatment for soil-borne fungi) of 4 adapted pinto cultivars were planted on 75-cm wide rows with a 25 cm wide bed - 2 lines spaced 15 cm apart on the bed - at the pure live seed rate (assume 85% germ) rate of 85,000 emerged plants/A or 207,300 plants/ha. Each plot was 2 beds wide by 3 meters in length. The complete experiment included: 2 irrigation systems, 4 pinto bean entries, 2 nitrogen rates, and 2 fungicide treatments, replicated 4 times.

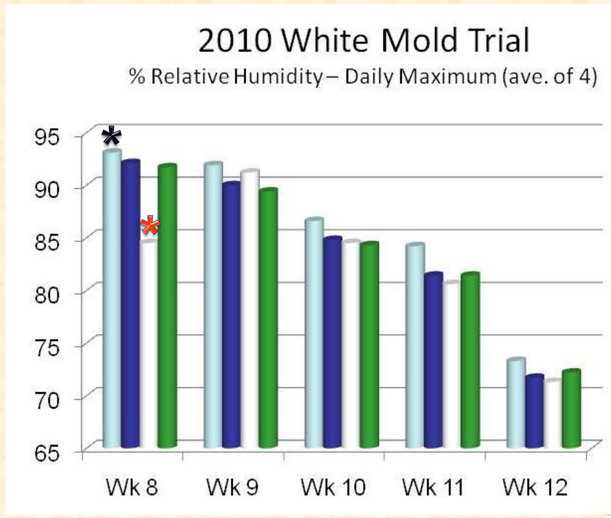
- **Colorado Locations** –
  A) CSU Research Farm near Fort Collins – furrow irrigated
  B) Commercial Grower Field north of Yuma – sprinkler irrigated
- **Entries –** pinto cultivars expressing architectural or resistance effects against white mold**:**
  (1) 'Montrose' – type III vine growth habit
  (2) 'CO 33875'– type II upright growth habit
  (3) 'Croissant' – type II upright growth habit
  (4) 'Stampede' – type II upright growth habit
- **Nitrogen (NPK) Rate –** broadcast by hand onto bed, incorporated during planting:
  a) N Carryover + grower practice
  b) a plus 75 lbs/A = 84 kg/ha

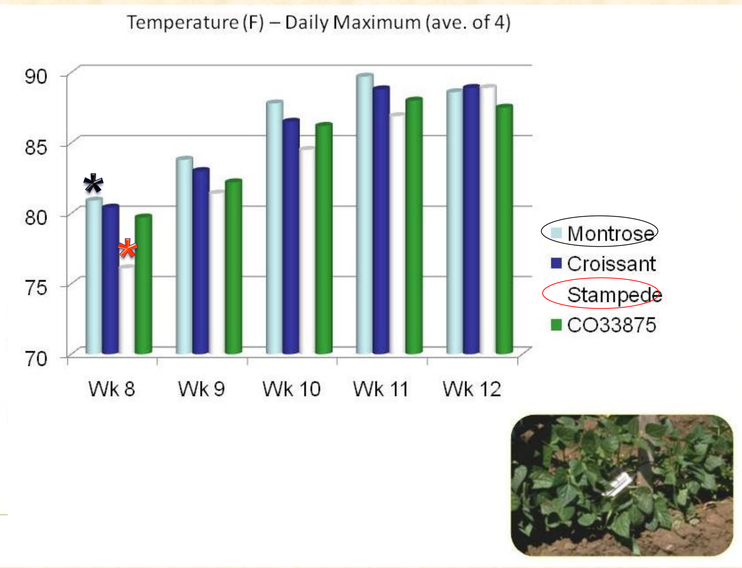
Fungicide Protection – Endura @ 77 kg/ha applied at 100% bloom and 100% + 7 days in 234 l water/ha with a CO_2 backpack sprayer on split plot (3 m length) of each entry and plant spacing
(i) Control, no fungicide
(ii) Endura, 2 sprays

Preplant soil tests determined soil type, texture, pH and the amount of nitrogen available to plants in Treatments (a and b). Standard grower practices were applied for fertilizer, irrigation, weed and insect management. Plant canopy monitoring during vegetative to reproductive periods of crop growth (e.g., weeks 4 to 12 after planting, or V3 to R7) measured air temperature and relative humidity at the soil surface between double lines of plant canopy of each variety and rep. The units were placed on top of the bed and out of the irrigation furrow and water or soil movement. Spectrum WatchDog (Spectrum Inc., Plainfield, IL) equipment (16 units) will be provided by Schwartz. Values were recorded hourly, and converted to daily minimum, maximum and average during the monitoring period. Field evaluations included 4-week post-planting emerged plant stand, flowering date (100% bloom), white mold disease intensity = incidence x severity (of 50 plants at 28-35 days post-bloom), and yield (as kg/ha, seed size as 100 seed weight). Field experiments evaluated agronomic, plant, and pathogen/disease responses to the effects of irrigation system, irrigation interval, fertility, cultivar and timely fungicide protection; economic impacts will also be reported. All data were analyzed statistically with PC SAS.

Entry responses combined for nitrogen & fungicide; (Yield as lb/Acre: seed as # / pound)

	Fort Collins	Yuma
Entry	Yield / Seed Wt	Yield / Seed Wt
Montrose	1368 a / 1240 c	3133 b / 1189 b
Stampede	1055 b / 1303 ab	3370 a / 1253 a
Croissant	1110 b / 1310 a	2981 b / 1203 b
CO 33875	1007 b / 1270 bc	2382 c / 1176 b
LSD-value $_{0.05}$:	*120.5 / 34.2*	*235.8 / 48.7*





RESULTS and DISCUSSION:

During 2010, we again encountered low white mold pressure in fields with a history of the disease apparently due to delayed plantings (early-spring rains) which delayed flowering until late July when weather conditions were warm and dry. In addition, the commercial field was moderately to severely damaged by bacterial brown spot which opened up the canopy of the commercial variety surrounding our trial and prevented the production of ascospore inoculum. Only 1 commercial field could be included this year due to the reduce budget allocation. However, the preliminary analysis of data from the 2 locations revealed that there were no interactions between fungicide treatment or nitrogen by entries or locations. Yields of the 4 entries averaged 1135 lb/acre (1281 seed/lb) at the research station and 2966 lb/acre (1204 seed/lb) at the better commercial field in the absence of white mold and with moderate bacterial disease at the commercial field in 2010; similar to results obtained in 2009. Plant canopy monitoring during late vegetative to seed fill periods of crop growth showed that average daily relative humidity was higher in a prostrate variety (Montrose) than an upright type (Stampede); and canopy temperature showed the reverse trend. The experiment will be repeated in 2011.

Outreach Plan: We will distribute results at annual meetings and progress reports (Annual Report of the Bean Improvement Cooperative) of our professional societies and in the on-line refereed publication, *Crop Management*, that will be published jointly by the American Society of Agronomy and American Phytopathological Society. This information will also be released to bean producers and others in CSU publications such as *From the Ground Up* (Soil & Crop Science) and regional newsletters. Results will also be distributed at annual field days and extension meetings and the Sclerotinia Initiative Annual Meeting during 2011.

These objectives support the SI area of Pathogen Epidemiology & Disease Management, and are relevant to PM 4.0.7 of the Strategic Plan for the Sclerotinia Research Initiative.

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